HIGH PERFORMANCE TAPE

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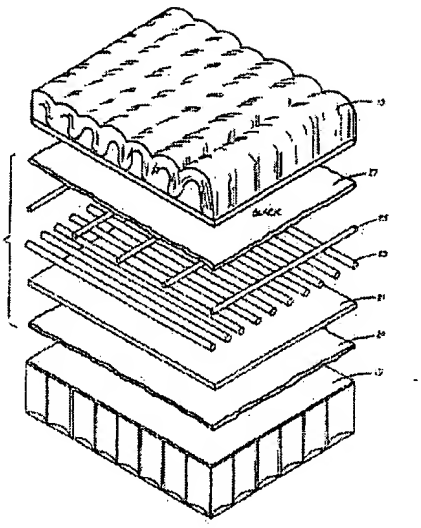
A tape (11) comprising a substrate (21) which provides a high strength at low weight, flame and smoke generation resistance and outside surfaces which have good wet out for adhering to pressure sensitive adhesives. A strand reinforcement (23, 25) may be adhered to the substrate for providing high strength reinforcement at low weight. A first adhesive layer (27) on the film substrate adheres the tape to the fabric, such as a floor covering. This adhesive layer is a pressure sensitive, moisture resistant adhesive. A second adhesive layer (29) on the film substrate adheres the tape to a floor surface. This adhesive layer comprises a thin layer of pressure sensitive, moisture resistant adhesive which has a low enough peel strength to permit the carpet and associated tape to be readily removed from the aircraft floor.



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(71) Applicant: ORCON CORPORATION [US/US]; 1570 Atlantic Street, Union City, CA 94587 (US).

(72) Inventors: LA MAR, Georgia, L. ; 23501 Matthew Court, Hayward, CA 94541 (US). VIJAYAKUMAR, Prema ; 4491 Macbeth Avenue, Fremont, CA 94536 (US).

(74) Agent: FEIX, Donald, C.; 241 North San Mateo Drive, San Mateo, CA 94401 (US).

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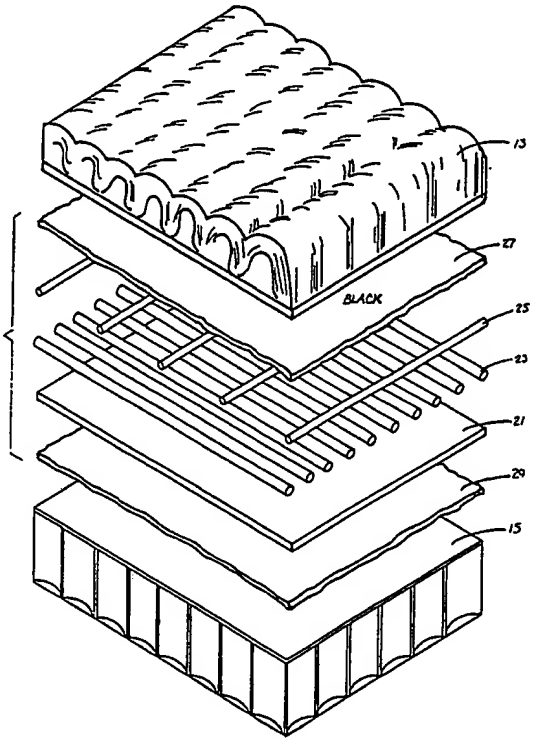
(57) Abstract

A tape (11) comprising a substrate (21) which provides a high strength at low weight, flame and smoke generation resistance and outside surfaces which have good wet out for adhering to pressure sensitive adhesives. A strand reinforcement (23, 25) may be adhered to the substrate for providing high strength reinforcement at low weight. A first adhesive layer (27) on the film substrate adheres the tape to the fabric, such as a floor covering. This adhesive layer is a pressure sensitive, moisture resistant adhesive. A second adhesive layer (29) on the film substrate adheres the tape to a floor surface. This adhesive layer comprises a thin layer of pressure sensitive, moisture resistant adhesive which has a low enough peel strength to permit the carpet and associated tape to be readily removed from the aircraft floor.



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HIGH PERFORMANCE TAPE

DESCRIPTION

Technical Field

This invention relates to a tape of the kind used for adhering a fabric to another surface.

This invention relates particularly to a tape for transportation vehicle applications of the kind in which fabrics, such as floor carpets and galley mats, are to be adhered to a vehicle surface or to a pad on the floor surface or to some other vehicle surface.

This invention relates particularly to a tape for transportation vehicle applications (such as, for example, aviation applications) of the kind in which flame and smoke retardant characteristics, low weight and moisture resistance characteristics, and the capability to be readily installed and removed while maintaining desired adhesive properties during normal use are important characteristics and capabilities.

Background Art

One tape that has been used in aviation applications of this kind has been a tape which comprises a cotton woven cloth tape with rubber based, pressure sensitive adhesives on the top and bottom surfaces of the tape.

This tape has presented a number of problems and has not been entirely satisfactory for use in aviation applications.

The cotton cloth is a relatively heavy component which requires excessive weight in order to provide adequate strength. Cotton also tends to absorb water when exposed to moisture.

Some rubber based, pressure sensitive adhesives also have unsatisfactory components. A rubber based adhesive

is a composite material which is made up of a number of substances which in themselves can cause problems. Rubber based adhesive may include in addition to the rubber, a tackifier, an antioxidant and fillers. One or more of these components may absorb moisture. A problem can also occur (over and extended time period) with oxidation which leads to loss of tackiness and subsequent brittleness.

The cotton backing and the rubber based adhesive also presents problems of flammability and smoke generation.

The rubber based adhesives can also, especially over time, become too permanent and can cause problems of leaving adhesive deposits on the aircraft floor when such tapes had to be removed. A rubber based adhesive can tend to delaminate from the cotton backing when the tape was removed because the cotton fabric provides a surface which is somewhat difficult for the rubber based adhesive to adhere to.

Cotton fabric tapes also tend to absorb moisture. This in turn led to problems of added weight, 32% of tape weight, when the tape did absorb water and led to problems of loss of adhesive properties because the adhesive lost its stickiness as it absorbed water.

Another problem of some rubber based adhesive was that those kinds of adhesives often were just not sticky enough to bond to different types of carpets.

Disclosure of Invention

It is a primary object of the present invention to construct a tape which avoids the problems and limitations of tapes previously used for transportation vehicle applications and particularly aircraft applications.

The tape of the present invention is a tape which is specifically constructed for applications of the kind in

which fabrics, such as floor carpets and galley mats, are to be adhered to a floor surface or to a pad on the floor surface or to some other vehicle surface. The tape of the present invention is constructed for applications in which the tape must have flame and smoke retardant characteristics, low weight and moisture resistant characteristics, and the capability to be readily installed and removed while maintaining desired adhesive properties during installation, use and removal.

The tape of the present invention incorporates a non-woven fabric substrate which will not absorb moisture. In a preferred embodiment in which the non-woven fabric substrate is a film, the film provides a moisture barrier, high strength at low weight, flame and smoke generation resistance and also provides outside surfaces which are smooth and have good wet out for adhering to associated pressure sensitive adhesives.

The tape of the present invention also preferably incorporates strand reinforcement which is adhered to the substrate for providing high strength reinforcement at low weight.

The tape of the present invention has a first, pressure sensitive, moisture resistant, adhesive layer. The first layer of adhesive is on the surface of the film on the side with the strand reinforcement which faces the underside of the carpet or other fabric and has high tack.

The tape of the present invention has a second, pressure sensitive, adhesive layer. This second adhesive layer is on the side of the tape which faces the floor and is a relatively thin layer of adhesive and is formulated to permit the tape and all associated adhesive to be removable from the floor without leaving patches of adhesive on the floor.

In preferred embodiments, the adhesive is an acrylic adhesive and has flame retardant additives.

In other embodiments the adhesive is a rubber based adhesive with suitable additives.

In a preferred embodiment the substrate is a plastic film, preferably either a polyester or a polyvinyl fluoride film, which has high dimensional stability in all directions, low moisture vapor transmission and low moisture pick up and which either has or is specifically formulated with additives to have flame retardancy. One or both of the outer surfaces of the film may be treated to improve the surface for adhering to pressure sensitive adhesives.

For some applications the substrate is a non-woven fabric substrate other than a film and is constructed to have the required characteristics, particularly dimensional stability in all directions and low moisture pick-up and flame retardancy.

The thickness and resulting weight of the substrate is kept to a minimum for the particular application area involved.

For example, in the case of a film substrate, the thickness of the film in aisle ways may be in the range of 1/4 mil to 1 mil. In other areas, particularly areas in which the carpet may be exposed to moisture, such as, for example, entrance ways, galleys and rest rooms, the film may have a greater thickness, in the range of 1/2 mil to 10 mils in order to provide increased resistance to moisture and increased resistance to puncture.

The strand reinforcement of the tape provides increased strength with minimum weight. By using strand reinforcement a thinner substrate can be used with a smaller overall product weight than would be the case if the increased strength were sought to be obtained by a

increasing thickness of the substrate by an amount needed to gain the added strength.

The material or materials used in the strand reinforcement are materials which are themselves flame and smoke resistant.

In one preferred embodiment the strands are polyester strands. The denier and the count of the strands are selected so as to provide both bidirectional strength and also increased strength in the traffic flow direction while maintaining efficient resistance to longitudinal splitting or tearing of the tape. The count and denier of the strand reinforcement are also selected to provide distribution of reinforcement strength as needed while permitting the tape, if necessary, to be torn by hand without the need for using a cutting tool. The count and denier of the strands, particularly the count and denier of the strands running in the longitudinal direction of the tape, are also selected to provide easy removal of the tape while keeping the tape from tearing during removal of the carpet and associated tape.

Both of the layers of pressure sensitive adhesive used in the tape are preferably formulated of an acrylic, pressure sensitive adhesive which is substantially resistant to oxidation.

In this specific embodiment of the present invention, the upper layer of the adhesive has a thickness less than 5 mils, preferably less than 3 mils.

The lower layer of adhesive is thinner and has a thickness less than 5 mils, usually less than 3 mils, preferably less than 1 mil. This thinner layer of the second lower adhesive provides a relatively low range of peel values (0.5 pounds per inch width to 2.0 pounds per inch width) so that the tape and associated fabric can be

readily removed without leaving any tape or residue on the vehicle surface.

In a preferred embodiment of the present invention the lower adhesive layer is not as aggressive as the upper layer.

The lower amount of aggressive characteristics of the lower layer facilitates being able to peel the tape from the floor. This is due to the adhesive being removable and fully crosslinked.

The higher aggressive characteristics of the upper layer make that layer more tacky and better able to adhere to the irregularities of the undersurface of the carpet and to facilitate both initial installation and the desired stability during use. This adhesive is self crosslinked and improves peel over time. But the upper layer is not so aggressive as to destroy the carpet by pulling tufts while the tape is being removed.

A silicone treated paper release liner is applied to the first adhesive layer so that the tape can be directly applied to the floor surface from the roll.

Tapes which embody the features and which are effective to function as described above constitute further, specific objects of the present invention.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show preferred embodiments of the present invention and the principles thereof and what are now considered to be the best modes contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

Brief Description of Drawings

Figure 1 is an isometric view of an aisle way in an airliner and shows how the tape of the present invention is used to adhere an aisle way carpet to the aircraft floor. In Figure 1 a part of the aisle way carpet has been illustrated as rolled back to show how three tapes of the present invention are used underneath the carpet to adhere the carpet to the floor.

Figure 2 is an enlarged plan view of a tape constructed in accordance with one embodiment of the present invention. Figure 2 is a top view of one of the three tapes shown in Figure 1. In Figure 2 a part of the top layer of adhesive of the tape has been removed to show details of the underlying strand reinforcement and film substrate structure.

Figure 3 is an exploded, isometric view of the tape shown in Figure 2 with carpet and floor surface shown.

Figure 4 is a side elevation view in cross section through the tape shown in Figure 2 and taken along the line and in the direction indicated generally by the arrows 4-4 in Figure 2.

Figure 5 is a side elevation view like Figure 4 but showing a construction of a tape, constructed in accordance with another embodiment of the present invention, using a woven scrim strand reinforcement on a film substrate.

Figure 6 is a schematic, side elevation view showing how two tapes constructed in accordance with the present invention are used to secure a carpet to a floor when a carpet pad or cushion is used for providing additional cushioning between the carpet and the floor.

Figure 7 is an isometric view of a tape constructed in accordance with an embodiment of the present invention

and packaged in a roll with a release liner ready for application to an aircraft surface.

Figure 8 is an exploded view like Figure 3 but showing another embodiment of a non-woven substrate.

Modes for Carrying Out the Invention

In Figure 1, three separate tapes 11, each constructed in accordance with one embodiment of the present invention, are used to adhere an aisle way carpet 13 to the floor 15 of an airliner in the passenger aisle way extending between the seats of the aircraft.

In Figure 1 the lower end of the carpet 13 has been illustrated as rolled up and back to show how the individual tapes 11 are positioned to hold the carpet in place and to show the underside 17 of the carpet which is engaged by the top surface of each of the three tapes 11.

Figures 2, 3 and 4 of the drawings show details of construction of the tape 11.

As best shown in exploded view of Figure 3, the tape 11 comprises a film 21 as the non-woven substrate, strand reinforcement which comprises warp strands 23 and fill strands 25, and upper adhesive layer 27 and a lower adhesive layer 29.

The fill strands 25 are adhered to the warp strands by a fill adhesive 31. The fill adhesive 31 is shown in Figure 4 but has been left out of Figure 3 for the purpose of simplifying the illustration in Figure 3.

The release liner 43 is shown in Figures 4, 5 and 7.

Tapes for transportation vehicle applications, particularly aviation applications, should provide a number of characteristics which are quite important in the transportation vehicle environment.

Weight is always an important consideration in any product used for aviation use. Flame and smoke

retardant characteristics are also quite important in aviation applications. High strength to weight characteristics are important. And, for use in certain areas of the aircraft, such as aisle entrance areas, galley areas and rest room areas, moisture resistant characteristics are quite important in the tape. It is important that the tape have a high degree of moisture resistance. Also, because there is a lot of foot traffic in aircraft entrance ways, aisle ways and other areas, it is very important that the tape will keep the carpet in place without permitting the carpet to curl or slip or wrinkle. The wheels of the galley carts exert very high load concentrations on the carpet and the underlying tape as the galley carts are pushed up and down the aisle ways, and the tape must hold the carpet securely in place during this kind of use. Because of the capital investment and the need for full utilization of the aircraft, the ground time of the aircraft must be held to a minimum, and this means that the time for installation and removal of the carpet must also be held to a minimum; so the tape of the present invention must permit easy and quick installation and removal of the carpet at such times as it may be necessary or desirable to remove old carpet and install new carpet.

The aircraft floor is a structural member in the aircraft and it is therefore important that any adhesive used in the tape 11 not stick to the floor of the aircraft on removal of the tape because such sticking would require scraping of the structural floor of the aircraft. The tape 11 must therefore be cleanly removable from the floor of the aircraft.

In some cases the aircraft flooring utilizes fiberglass panels, and the tape 11 must not delaminate or cause any injury to aircraft panels. The tape must

therefore have a band of adhesion which is large enough to keep the carpet in place but which is not so excessive as to leave any residue or damage any aircraft panel structure when it is required to remove the tape from the panel structure.

The construction and functioning of the tape 11 of the component parts of the tape 11 of the present invention therefore has considerable significance and must comply with certain requirements in order to provide a successful product for aviation applications.

In accordance with one specific embodiment of the present invention the non-woven fabric substrate 21 comprises a plastic film.

In one preferred embodiment the film is a polyester film and the surface of the film on the side which will face the floor 15 is a surface which has been treated to improve the compatibility for adhering that surface to adhesive on that side of the film.

In another specific embodiment of the present invention the film comprises a polyvinyl fluoride film, and in that embodiment the film is formulation modified to have retardants added to the film itself.

In a preferred embodiment of the present invention both outer surfaces of the plastic film are treated to improve the compatibility for adhering to adhesives.

In another embodiment of the present invention, the non-woven fabric substrate comprises a non-woven multi-directional, fiber fabric which is light weight, strong, and fire retardant and which has low moisture pick-up.

In all embodiments of the present invention the substrate is made from a material which has high dimensional stability in all directions so as to provide a maximum of strength and resistance to distortion with a minimum of weight for that component of the tape.

The plastic film is made of a material which has fire retardant properties capable of making the film self extinguishing under applicable Federal aviation regulations such as, for example, regulation No. 25.853(b).

For many of the areas of the aircraft in which the tape 11 is to be used, the tape can comprise a film which has a thickness less than 20 mils, usually less than 5 mils, preferably 1/2 mil. For example, for use in those areas of the aircraft which are not normally exposed to high moisture or high wear, such as in aisle ways and under seats, or areas that have a moisture seal applied, a tape in the thickness of 1/4 mil to 1 mil can be used.

On other areas of the aircraft such as, for example, in the entrance area, in the galley area, and in the rest room area, where a very high moisture seal and high resistance to puncture properties are significant, the film may have a thickness less than 20 mils, usually less than 10 mils, depending upon the particular requirements.

The tape 11 of the present invention preferably includes strand reinforcement associated with the substrate because the strand reinforcement can provide a higher amount of strength at somewhat lower weight than can be accomplished than just by increasing the thickness of the substrate.

In a preferred embodiment of the present invention the strand reinforcement comprises strands which are bidirectional warp and fill strands. In a specific embodiment of the present invention, as shown in Figures 2, 3 and 4, the bidirectional strands comprise a non-woven fabric in which the fill strands 25 are adhered to the warp strands 23 and to the underlying film 21 by a fill adhesive 31 which is associated with fill strands 25 as illustrated in Figure 4.

In one specific embodiment of the present invention the fill adhesive 31 is a fire retardant adhesive.

In a preferred embodiment of the present invention the warp strands are selected to have a denier and a count to provide a relatively uniform reinforcement to the film and to permit the film to be slit longitudinally while still retaining relatively uniform reinforcement. That is, for example, enough warp strands are used to impart reinforcement to a number of longitudinal locations extending across the width of the tape, rather than having a smaller number of larger strands which could possibly induce non-uniformity of reinforcement, particularly when it is necessary to slit the tape.

In another specific embodiment, as shown in Figure 8, the non-woven fabric substrate 22, comprises a non-woven multi-directional, fiber fabric. The fabric 22 can be used in place of the film 21, as shown in Figure 8, or the fabric 22 can be used in place of the scrim 23,25 and the film 21, depending on the strength required for the tape.

In one embodiment of the present invention, in which the tape 11 has a width of about 2 inches, the warp strands are substantially uniformly spaced and the count of the warp strand is substantially 6 warp strands per inch. In this embodiment the warp strands are approximately 220 denier. This denier is large enough to provide the desired strength in the longitudinal, warp direction, the direction of traffic flow in an aisle way, while still permitting the tape to be torn by hand, if necessary, rather than absolutely requiring the tape to be cut by a cutting tool. A relatively high count of warp strands also provides increased resistance to breakage at such times as it is necessary to remove the carpet and the tape.

In the embodiment of the invention shown in Figure 2 the fill strands are substantially 2 strands per inch and are approximately 70 denier. This relatively low number of small size fill strands has been found adequate to provide sufficient resistance to tearing or splitting along the longitudinal direction of the tape.

The preferred material for the warp and fill strands is a polyester material. The strand reinforcement is made of a material or materials which are flame resistant and smoke resistant and which have self-extinguishing characteristics in the event of exposure to flame and have high tensile strength and resistance to moisture pick up.

While a non-woven scrim strand reinforcement is preferred for weight and strength, a woven scrim fabric, as shown in Figure 5 can be used in certain applications.

As illustrated in Figure 5 the warp strands 23 are woven with the fill strands 25. Also, the adhesive for adhering the strand reinforcement to the film 21 is a surface coating of adhesive 31 instead of the fill strand adhesive 31 as shown in Figure 4.

The other important components of the tape of the present invention are the first adhesive 27 which adheres the tape to the overlying fabric or to padding and the second adhesive 29 which adheres the tape to the floor or to padding on the floor (see Figure 6) of the vehicle.

As best illustrated in Figure 4, the first adhesive layer 27 has a somewhat irregular upper surface which basically follows the contours of the underlying strand reinforcement.

The properties that this layer of adhesive must have include being pressure sensitive, having a high degree of tack, a high degree of resistance to moisture, and a high resistance to shear. This layer of adhesive 27 (or the

film 21) also preferably has a black color for optical properties.

The high tack of the pressure sensitive adhesive is important in order to provide improved adhesion to irregular surfaces, such as the underside of fabrics and good instantaneous tack so that when a carpet is rolled out it can be installed substantially instantaneously.

This layer 27 of adhesive is formulated to have high shear strength so that the carpet will not scoot on the tape and so that any tendency of the associated fabric to wrinkle will be minimized. The adhesive (whether acrylic or rubber based) of this layer is formulated to have less than one percent moisture pickup and remains tacky when wet so that this layer of adhesive in combination with the film 21 provides a very effective barrier to moisture. This layer of adhesive 27 is formulated to have a moderate peel strength so that a carpet can be readily picked up (without removing the carpet tufts) when the carpet is to be removed and replaced, but so that the carpet will nevertheless stay in place during the installation and use.

In a specific embodiment of the invention the adhesive 27 has a thickness in the range of 2 mils to 3 mils and is a cross-linked acrylic adhesive.

The second adhesive layer 29 is preferably a clear adhesive. It too must have pressure sensitive characteristics. In a specific embodiment of the present invention this adhesive layer 29 is formulated of an adhesive which provides peel values that stay consistent over time and do not substantially increase or decrease while the tape is used to adhere the tape to the associated fabric and the aircraft surface. The adhesive 29 has a low range of peel values so that the tape and associated fabric can be readily removed from the aircraft

surface. In a specific embodiment of the present invention the adhesive 29 has a thickness in the range of 0.7 mil to 1.5 mil.

Both of the adhesives 27 and 29 have sufficient moisture resistance to retain tack in the event that the overlying fabric 13 gets wet.

In some aircraft installations a padding is used under the carpet. The tape 11 of the present invention is, however, usable for those installations in which a padding might be desired, and the way that the tape 11 of the present invention is used in such a case is illustrated in Figure 6. In Figure 6 two tapes 11 are used to adhere a carpet fabric 13 to a floor 15 when a pad 41 is desired. In this case a tape 11 is interposed in the pad 41 and a second tape 11 is interposed between the carpet 13 and the top of the pad 41. The pad can be either a fabric mesh (a pad in which fabric is used over foam) or a fabric pad without foam. The adhesives of the tape 11 provides sufficient tack for retaining the carpet in place in either event.

The embodiments of the tape disclosed in the preceding description and shown in the drawings of this application are further illustrated through the following examples. These examples, while illustrating preferred embodiments of the tape, are not to be considered a limitation thereon, it being understood that many variations and modifications, when employed by those skilled in the art, may be practiced without departing from the spirit and scope of the present invention as defined by the claims.

Industrial Applicability

EXAMPLE 1

This example is described with reference to Figs. 2, 3, 4 and 7 described above and with the structure and components identified as follows:

The silicone coated release paper 43 shown in Fig. 4 is a kraft paper coated with a silicone coating on both outside surfaces so as to provide equal release with respect to adhesives engaged with those outside surfaces. This silicone treated paper is a standard product which may be obtained from any number of suppliers.

The first adhesive layer 27 is an acrylic adhesive which had been colored with a black color and which has a fire retardant additive added to the formulation of the adhesive layer. The thickness of this adhesive layer is 2.5 mil and the adhesive is self cross-linked so as to provide instantaneous tack to the underside of carpet. This layer of adhesive has an irregular upper surface for increasing adhesion to the irregularities of the under surface of the carpet. The acrylic adhesive is of a type available, for example, from Morton Chemical under the trade designation Adcote 73A207A.

The fire retardant additive is of a type available, for example, from Stauffer Chemical under the trade designation Fyrol C E F.

The strand reinforcement 23-25 comprises polyester strands 23 of 220 denier with a spacing of 6 yarns per inch.

The strands 25 are polyester strands of 70 denier with spacing of 2 fibers per inch.

The adhesive 31 is a fire retardant adhesive suitable for adhering polyester strands to a plastic film substrate and compatible with the acrylic adhesive of the first adhesive layer 27.

The non woven fabric substrate 21 is a polyester plastic film corona treated on the surface which is opposed to the adhesive 29. The film is 1/2 mil thick. This film can be bought from any number of suppliers.

The second adhesive layer 29 comprises a clear acrylic adhesive which has a fire retardant additive. The acrylic adhesive of the layer 29 is fully crosslinked so as to be removable from the vehicle floor. The thickness of the layer 29 is 1 mil. This acrylic adhesive is of the type available, for example, from B. F. Goodrich Company under the trade designation HYCAR 26146 or from Morton Chemical under the trade designation ADCOTE 73A224.

The tape produced in this example is particularly suited for use in an aircraft for adhering carpet to the aircraft floor in the aisleways and under seats of the aircraft.

EXAMPLE 2

The components of Example 1 were repeated except that the substrate 21 is a polyester film with a thickness to 10 mils and the strand reinforcement 25 is a polyester strand of 220 denier with spacing of 6 fibers per inch. The first adhesive layer 27 is also a clear adhesive to provide viewing of the floor surface through the tape.

The thicker film provides durability and puncture resistance as well as an effective moisture seal. The strand reinforcement 23-25 is the same type and density in both directions to provide uniform strength in both transverse and cross directions.

The type produced in this example is particularly suited for use in the aircraft galley area for installing galley mat to the floor surface.

EXAMPLE 3

The components of Example 1 were again repeated except that strand reinforcement 23-25 is a woven scrim reinforcement, as shown in Fig. 5, rather than a non-woven strand reinforcement 23-25. The adhesive 31 used to bond the reinforcement to the substrate 21 is applied as a coating to the substrate rather than a coating on the cross strands 25.

EXAMPLE 4

The components of Example 1 were repeated except that the substrate 21 is a non-woven, multidirectional fiber fabric as shown in Fig. 8, rather than a plastic film substrate.

The non-woven, multidirectional fiber fabric provides uniform strength in all directions. A suitable material is resistant to moisture pickup and is fire retardant.

EXAMPLE 5

The components of Example 4 were repeated except that the strand reinforcement 23-25 and the adhesive 31 are omitted. A substrate 21 should have adequate strength in the longitudinal direction to allow for removal of the tape without tearing.

EXAMPLE 6

The components of Example 1 were repeated except that the first adhesive layer 27 is a rubber based adhesive and the second adhesive layer 29 is a rubber based adhesive. Rubber based adhesives of this type available, for example from Morton Chemical under the trade designation Adcote 72A209 for the first adhesive layer 27 and Morton Chemical under the trade designation Adcote 72A125 for the second adhesive layer 29.

While we have illustrated and described the

preferred embodiments of our invention, it is to be understood that these are capable of variation and modification and we therefore do not wish to be limited to the precise details set forth, but desire to avail ourselves of such changes and alterations as fall within the purview of the following claims.

The Claims

1. A tape for transportation vehicle applications of the kind in which fabrics, such as floor carpets and galley mats, are to be adhered to a floor surface or to a pad on the floor surface or to some other vehicle surface, and in which applications flame and smoke retardant characteristics and low weight and moisture resistance characteristics and the capability to be readily installed and removed while maintaining desired adhesive properties during installation and use are important characteristics and capabilities, said tape comprising,

non-woven fabric substrate means for providing resistance to moisture pick-up, dimensional stability inall directions, flame generation resistance, and outside surfaces which have good wet out for adhering to adhesives,

first adhesive means on a first surface of the film substrate means for adhering the tape to a fabric or coated fabric, such as floor coverings and gallery mats, and comprising a pressure sensitive, moisture resistant, flame retardant adhesive, and

second adhesive means on a second surface of the film substrate means for adhering the tape to a floor surface or to a pad on the floor surface or to some other aircraft surface, and comprising a thin layer of pressure sensitive, moisture resistant, flame retardant adhesive which is formulated and applied in a thickness so as to be substantially entirely removable from the aircraft or pad surface to which the tape is attached when the fabric is to be removed and/or replaced.

2. The invention defined in claim 1 wherein the non-woven fabric substrate means comprise a film which provides a moisture barrier, high strength at low weight, and smoke generation resistance.

3. The invention defined in claim 1 wherein the non-woven fabric substrate means comprise a non-woven, multi-directional, fiber fabric.

4. The invention defined in claim 2 wherein the film is a plastic film and including strand reinforcement means adhered to the film for providing high strength reinforcement at low weight.

5. The invention defined in claim 4 wherein the film substrate means comprises a film which has a thickness less than 20 mils, usually less than 5 mils, preferably 1/2 mil for use in adhering aircraft carpet to aircraft floors in areas not normally exposed to high moisture or wear such as in the aisle ways and under seats.

6. The invention defined in claim 4 wherein the film substrate means comprise a film which has a thickness less than 20 mils, usually less than 10-mils, for use in adhering aircraft galley mats to aircraft floor panels in locations where a very high moisture seal and resistance to puncture properties are significant.

7. The invention defined in claim 4 wherein the film substrate means comprises a polyester film.

8. The invention defined in claim 4 wherein the film substrate is coated with a black coating for optical properties and the first adhesive means comprise a clear adhesive.

9. The invention defined in claim 7 wherein at least the second surface of the film has been treated to improve the compatibility for adhering to adhesives on that side of the film.

10. The invention defined in claim 41 wherein the film comprises a polyvinyl fluoride film which is formulation modified to have fire retardants added to the film itself.

11. The invention defined in claim 10 where both the outer surfaces of the film have been treated to improve the compatibility for adhering to adhesives.

12. The invention defined in claim 4 wherein the film substrate means comprises a film which has a metalized coating to provide low moisture vapor transmission.

13. The invention defined in claim 41 wherein the film substrate means includes a film made of a material which has fire retardant properties capable of making the film self-extinguishing under applicable Federal Aviation Regulations.

14. The invention defined in claim 4 wherein the film substrate means includes a plastic film or non-woven fabric which provides high strength at low weight and is resistant to moisture pick up.

15. The invention defined in claim 4 wherein the strand reinforcement means includes polyester or other high strength, los flammability, high moisture resistant strands.

16. The invention defined in claim 4 wherein the strand reinforcement means include strands which are bidirectional warp and fill strands and wherein the warp strands are approximately 220 denier and wherein the fill strands are approximately 70 denier.

17. The invention defined in claim 10 wherein the strand reinforcement means include strands which are bidirectional strands comprising warp strands and fill strands and wherein the warp strands are substantially six yarns per inch and wherein the fill strands are substantially two strands per inch and wherein the tape is to be installed with the warp strands extending in the direction of the main foot traffic flow in the aircraft and wherein the higher count of warp strands also provide increased

resistance to breakage when the carpet and tape is being removed.

18. The invention defined in claim 17 and wherein the warp strands have a denier of substantially 220 so that there are a relatively high number of warp strands are distributed across the tape to provide flexibility in slitting the tape while retaining relatively uniform strength in the parts of the tape as slit and wherein the denier is a low enough magnitude so that the tape can, if necessary, be torn by hand without the use of a cutting tool.

19. The invention defined in claim 4 wherein the strand reinforcement means are made of materials which are flame resistant and smoke resistant and which have self extinguishing characteristics in the event of exposure to flame.

20. The invention defined in claim 4 wherein the strand reinforcement means are adhered to the film by a polyurethane adhesive which has been treated to provide fire retardant characteristics to the adhesive and wherein a minimal amount of adhesive is associated with the fill strand in order to keep the weight of the tape as low as possible.

21. The invention defined in claim 1 wherein the first adhesive means include a black color for optical properties.

22. The invention defined in claim 1 wherein the adhesive of the first adhesive means is formulated to be very tacky for providing improved adhesion to irregular surfaces such as the underside of fabrics and good instantaneous tack so that when the carpet is rolled out it can be installed substantially instantaneously.

23. The invention defined in claim 1 wherein the adhesive of the first adhesive means is formulated to have

high shear strength so that a carpet will not scoot on the tape and so that any tendency of the associated fabric to wrinkle will be minimized.

24. The invention defined in claim 1 wherein the adhesive of the first adhesive means has a moderate peel strength so that a carpet can be readily picked up and not damaged, but the carpet will still stay in place during installation and use.

25. The invention defined in claim 1 wherein the adhesive of the first adhesive means is formulated to have less than 1 percent moisture pickup.

26. The invention defined in claim 1 wherein the adhesives of the first and second adhesive means are formulated of an acrylic which is substantially resistant to oxidation and which has a flame retardant additive.

27. The invention defined in claim 1 wherein the adhesive of the first adhesive means has a thickness less than 5 mils, preferably less than 3 mils.

28. The invention defined in claim 1 wherein the adhesive of the second adhesive means is formulated of an adhesive which provides peel values that stay consistent over time and do not substantially increase or decrease while the tape is used to adhere the tape and associated fabric to the aircraft surface due to it being full crosslinked.

29. The invention defined in claim 1 wherein the adhesive of the second adhesive means has a low range of peel values so that the tape and associated fabric can be readily removed from the aircraft surface without leaving adhesive residue on the aircraft floor surface.

30. The invention defined in claim 1 wherein the adhesive of the second adhesive means has a thickness less than 5 mils, usually less than 3 mils, preferably less than 1 mil.

31. The invention defined in claim 1 wherein the adhesives of both the first and second adhesive means have sufficient moisture resistance to retain tack in the event that the overlaying fabric gets wet.

32. The invention defined in claim 1 wherein the strand reinforcement means are tailored to provide high strength in one direction and tailored by choice of materials to provide the properties needed.

33. The invention defined in claim 1 wherein the first and second adhesive means comprise an acrylic adhesive.

34. The invention defined in claim 1 where the first and second adhesive means comprise a rubber based adhesive.

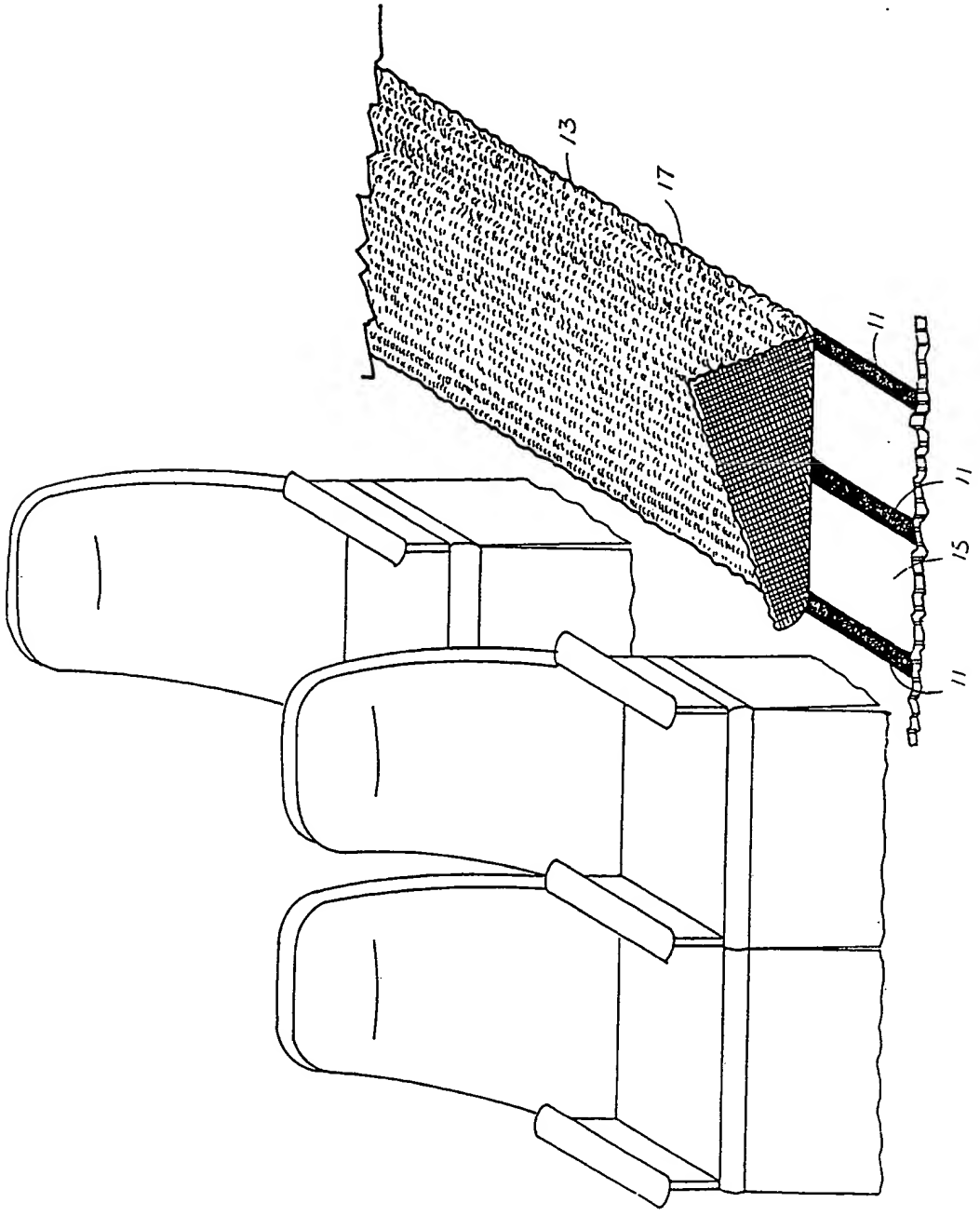


FIG. 1

FIG. 2

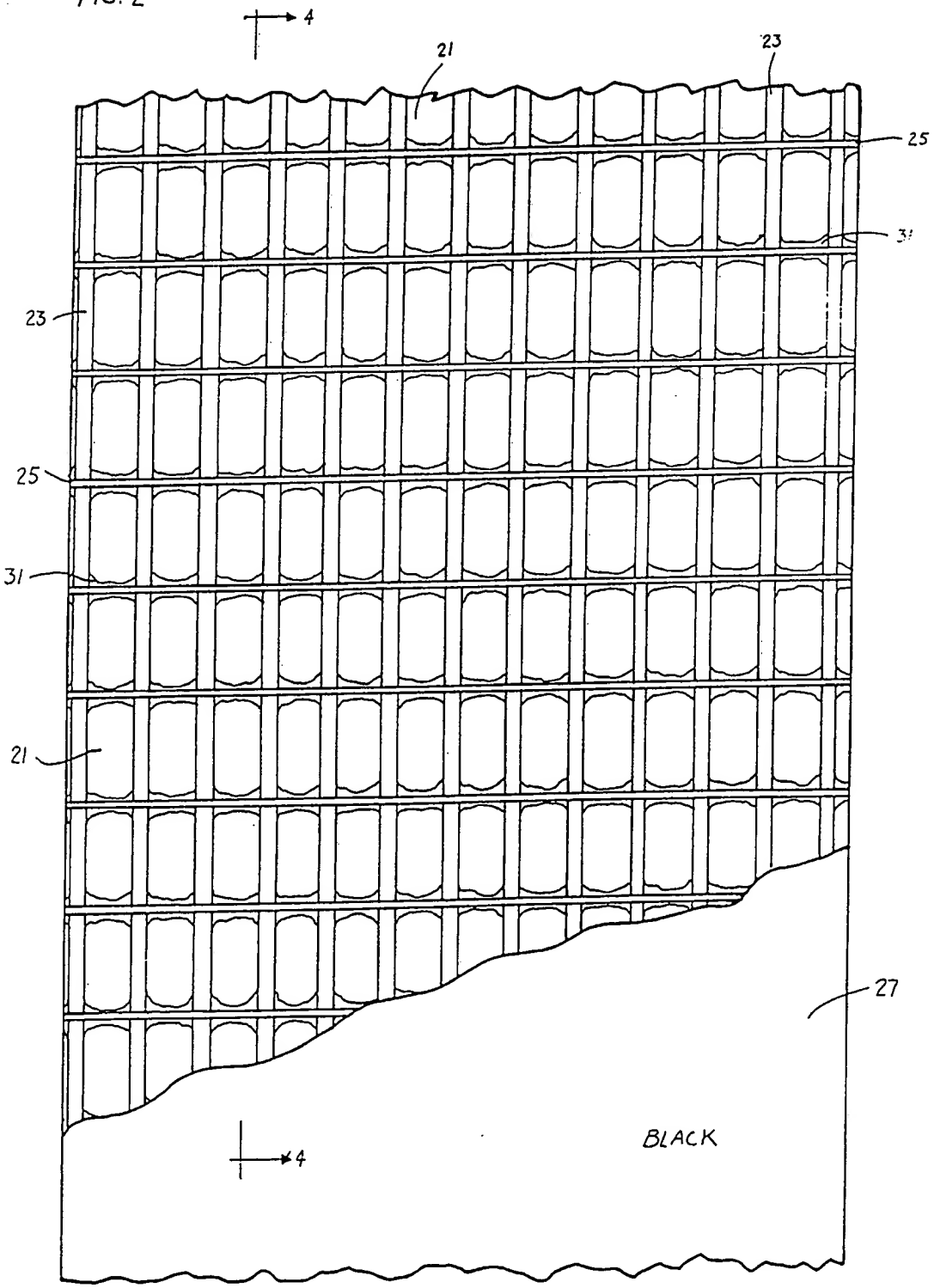


FIG.3

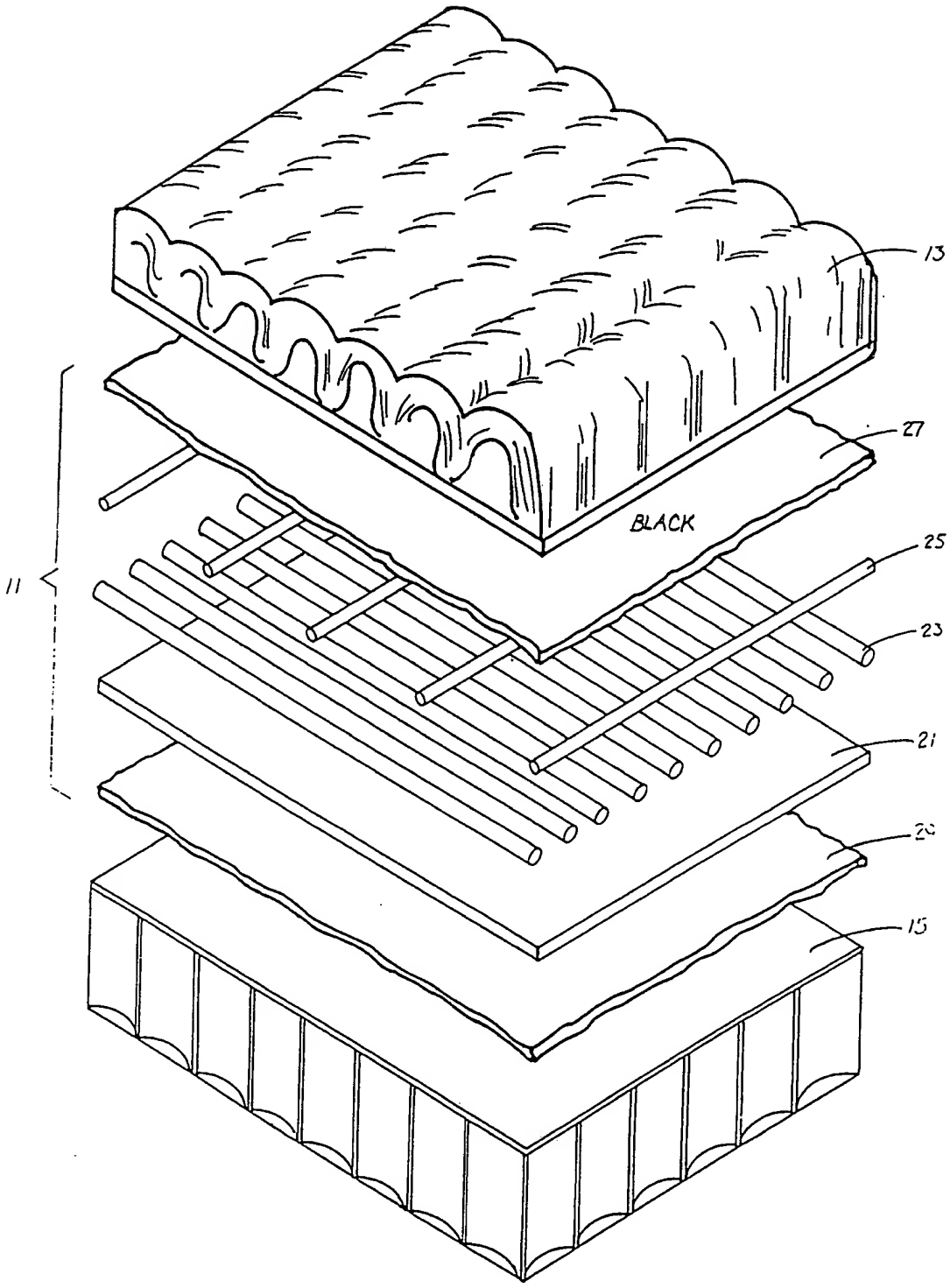


FIG. 4

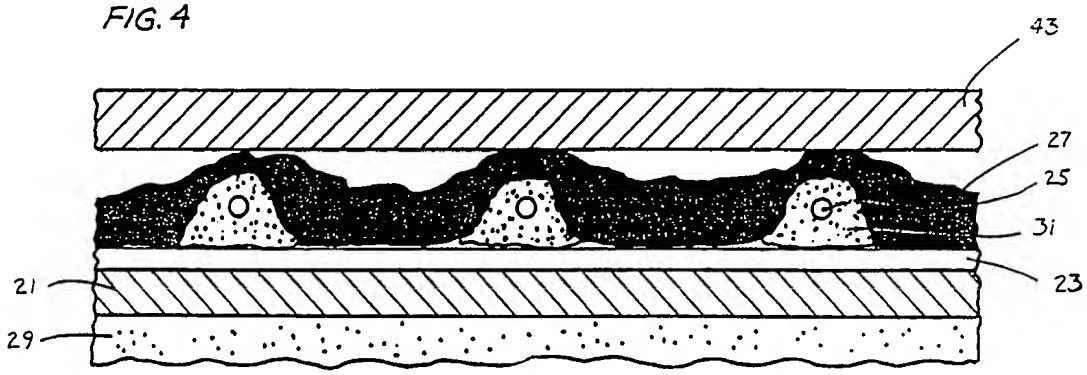


FIG. 5

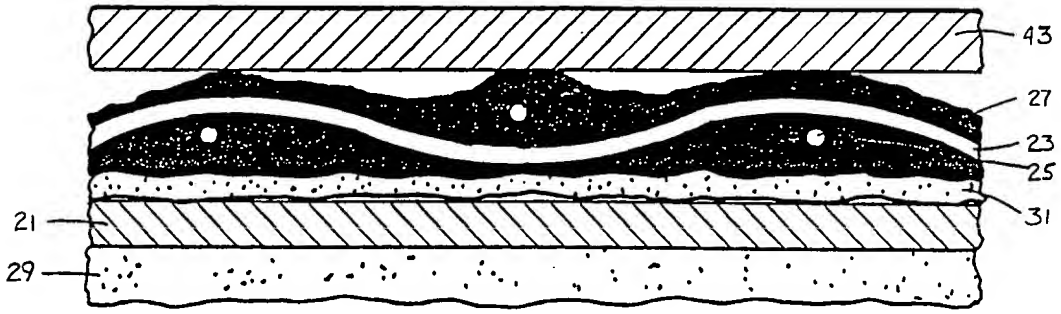


FIG. 6

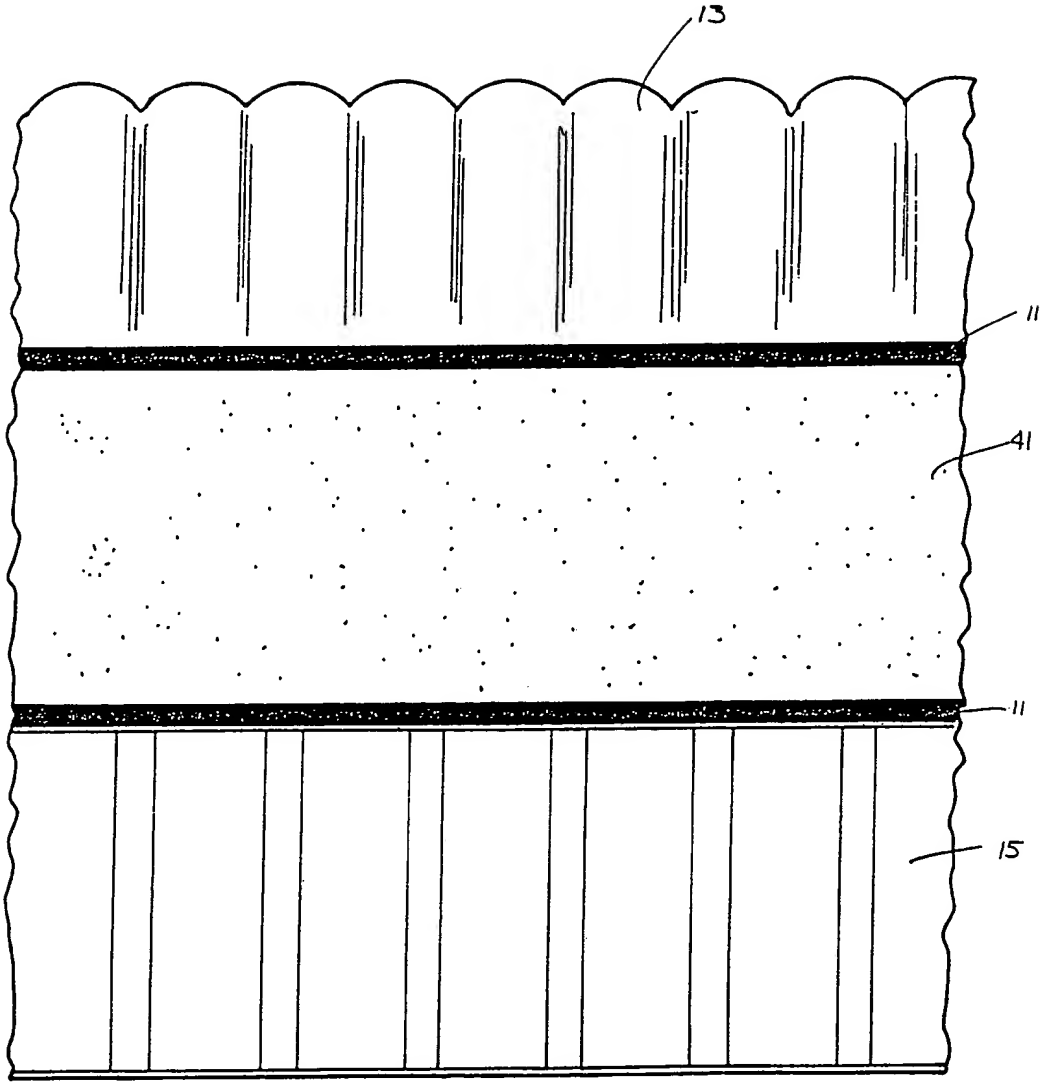


FIG. 7

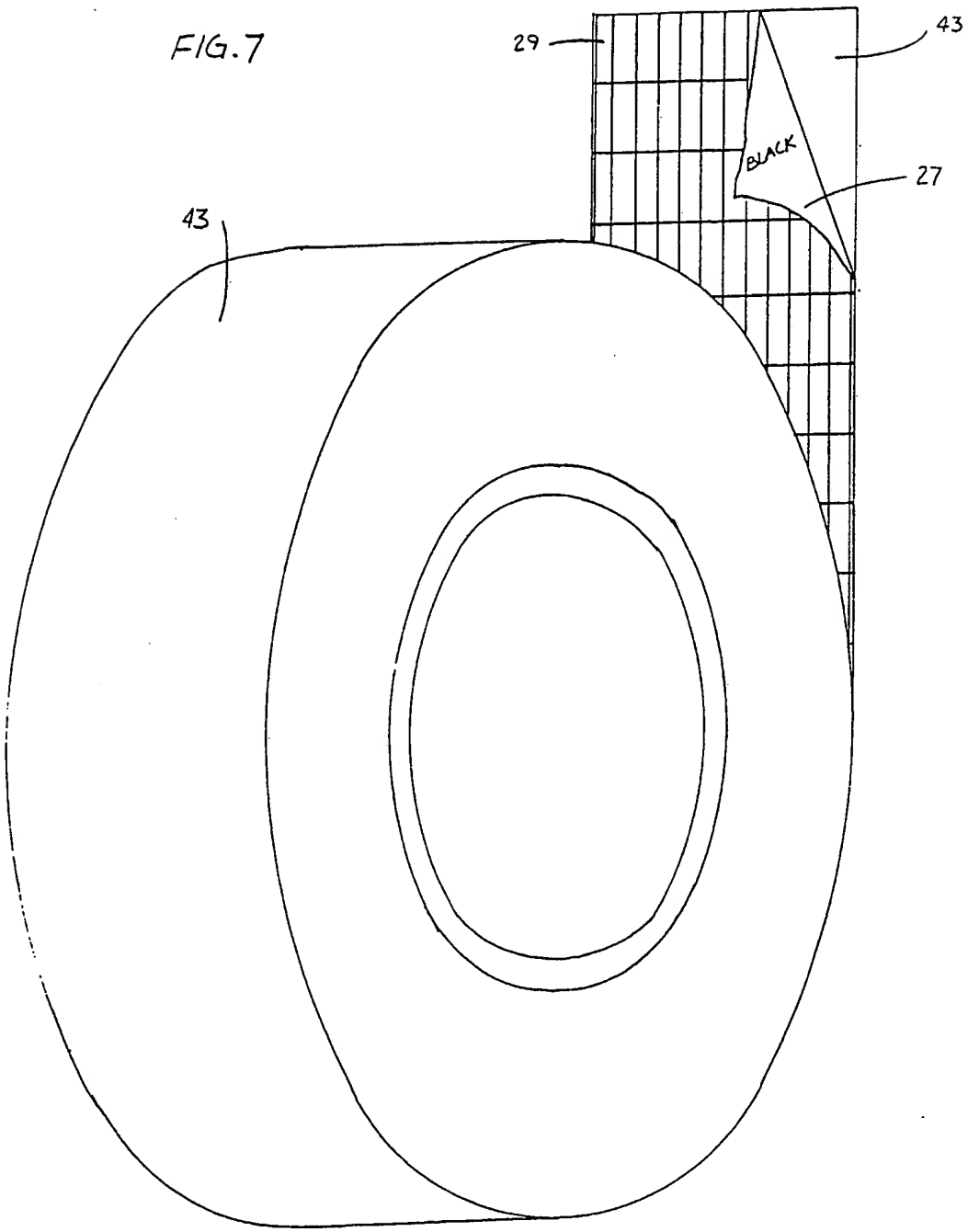
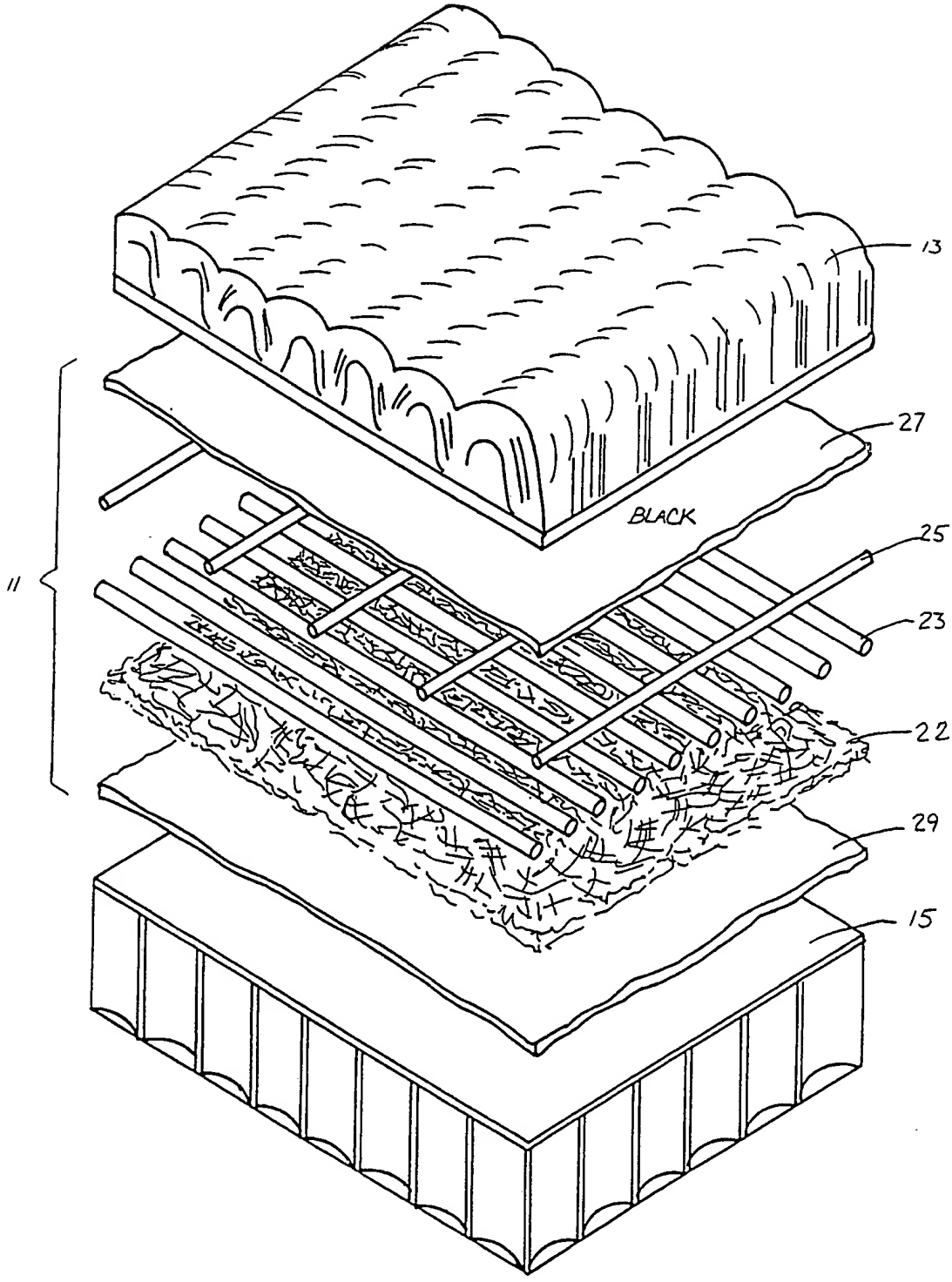


FIG.8



INTERNATIONAL SEARCH REPO.

International Application No. PCT/US89/03384

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl 4 B32B 5/12
US Cl 428-109, 110

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
US	428/109,110,111,112,113

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No [13]
A	US, A 3,616,133 (Thomas) 26 October 1971	1-34
A	US, A 4,460,633 (Kobayashi) 17 July 1984	1-34

* Special categories of cited documents: [10]

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

20 OCTOBER 1989

Date of Mailing of this International Search Report

15 DEC 1989

International Searching Authority

ISA/US

Signature of Authorized Officer

W.J. Van Balen

Form PCT/ISA/210 (second sheet) (Rev.11-87)